

CHAPTER 12

PC 2001 Audio

INDUSTRY EARLY REVIEW DRAFT V.0.3 — 07/20/1999 7:27 PM–

NOTE to REVIEWERS: This is a very early draft version, and no effort has been made to reconcile changes in cross references to other chapters in the guide. Please look for comments such as this in the draft, which encourage your feedback on specific issues.

Please submit comments using the form on <http://www.pcdesguide.org> or by sending e-mail to comments@pcdesguide.org.

IMPORTANT: The requirements defined in this guide provide guidelines for designing PC systems that will result in an optimal user experience with typical Windows-based applications running under either the Microsoft Windows98 “Millennium” or later or Windows2000 Professional or later operating systems. These design guidelines are not the basic system requirements for running any version of Windows operating systems.

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Basic Audio Requirements

This section defines basic hardware feature requirements for audio components. These are system-based requirements, targeted for the entire PC solution as it ships, regardless of whether the audio components are separate add-on devices or are built into the system, for example, on the system board or the display monitor.

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This section summarizes the system requirements for audio.

~~17.1 [DELETE] PC1 system includes PC 2001 audio capabilities~~

[17.2] [REDUNDANT] Audio device does not connect to ISA bus

Note to Reviewers: “No ISA” is a basic PC 2001 requirement

[17.3] Audio device does not use legacy hardware interfaces for MS-DOS–based applications

If the audio device supports MS-DOS–based applications, it must use operating system–provided or operating system–compatible software emulation of legacy interfaces when the application is running. Legacy hardware does not meet PC 2001 requirements if the legacy technique allows MS-DOS–based applications to communicate directly with ISA IRQ, DMA, or I/O hardware resources, such as PC/PCI or DDMA.

When running MS-DOS–based applications in a virtual MS-DOS box, the level of legacy compatibility provided by Windows 98 software emulation is comparable to hardware. ~~Support for legacy hardware techniques in real-mode MS-DOS, Windows 3.1, or Windows 95 is acceptable, as long as it does not interfere with Windows 98 operation.~~

This requirement also applies to PCI–based audio devices. Whether Windows–based or MS-DOS–based applications are running, the PCI device must not allocate or use ISA IRQs, DMAs, or hard-coded I/O locations. The BIOS and Windows driver must not contain any options to select the use of ISA resources for the audio device.

If a device supports real-mode operation, the only acceptable manner for acquiring ISA resources is to use a real-mode configuration utility.

Audio Performance and Feature Requirements

This section summarizes the performance requirements for audio on PC 2001 systems.

Several companies joined together to develop *Personal Computer Audio Quality Measurement* (PCAQM), a standard testing procedure for defining and measuring audio performance. Contributors to PCAQM include Audio Precision, Compaq Computer Corporation, Crystal Semiconductor, Intel Corporation, and Microsoft Corporation. PCAQM definitions and test methods are available from the web site at <http://www.cirrus.com/products/papers/meas/meas.html>.

[17.4] If implemented, audio performance meets PC 2001 requirements

The following table summarizes audio performance requirements for all audio–enabled PC 2001 systems, with the exceptions noted for mobile audio. These requirements establish a minimum performance level for PCs; system designers

are encouraged to exceed these minimum requirements, ~~especially for Consumer PCs.~~

Mobile PC Note

~~Most specifications and tests isolate half-duplex play or record performance. Additional attention should be paid to full-duplex systems with an embedded microphone and speakers, such as mobile PCs and multimedia monitors, where acoustic coupling can significantly degrade microphone performance.~~

For precise definitions of the terminology used in the following table, please refer to the PCAQM test methodology paper cited earlier in this section.

PC 2001 Audio Minimum Performance Requirements

Feature	Requirement	Value
Full-scale input voltage	FSIP (A-D-PC) line input	? 2.0 Vrms
	FSIP (A-D-PC) microphone input	? 100 mVrms
Full-scale output voltage	FSOP (PC-D-A) line output	? 1.0 Vrms ¹
Analog pass-through (A-A)	Line input to line output	
	Frequency response (-3 dB)	20 Hz to 20.0 kHz ⁴
	Dynamic range (SNR)	? 80 dB FS A ⁴
	THD+N (-3 dB FS)	? -65 dB FS ⁴
	Microphone input to line output	
	Frequency response (-3 dB)	100 Hz to 12.0 kHz
	Dynamic range (SNR)	? 70 dB FS A ⁴
	THD+N (-3 dB FS)	? -60 dB FS ⁴
	Line input to speaker output with 8-ohm load ²	
	Frequency response (-3 dB)	20 Hz to 20.0 kHz ⁴
	Dynamic range (SNR)	? 70 dB FS A ⁴
	THD+N (-3 dB FS)	? -55 dB FS ⁴
Digital playback (PC-D-A) for line output	Frequency response (-3 dB)	
	44.1 kHz source material	20 Hz to 17.6 kHz ⁴
	48.0 kHz source material	20 Hz to 19.2 kHz ⁴
	Dynamic range (SNR)	? 80 dB FS A ^{3, 4}
Digital recording (A-D-PC) for line input	THD+N (-3 dB FS)	? -65 dB FS ⁴
	Frequency response	
	44.1 kHz destination	20 Hz to 17.6 kHz ⁴
	48.0 kHz destination	20 Hz to 19.2 kHz ⁴
	Dynamic range (SNR)	? 70 dB FS A ⁴
Digital recording (A-D-PC) for microphone input	THD+N (-3 dB FS)	? -60 dB FS ⁴
	Frequency response (-3 dB)	
	22.05 kHz destination	100 Hz to 8.8 kHz
	Dynamic range (SNR)	? 70 dB FS A ⁴
Line output cross-talk	THD+N (-3 dB FS)	? -60 dB FS ⁴
	Channel separation between left and right	? 60 dB ⁴

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line out channels (measured at 10 kHz)		
Sampling frequency accuracy	Playback	0.1%
	Record	0.1%

¹ For mobile PCs with 3.3 V audio subsystems, the required Full Scale Output Voltage for line output is ≥ 0.7 Vrms.

² Line input to speaker output is a requirement only if a line output is not supported.

³ Decibels relative to full scale (FS), measured using "A weighting" filters.

⁴ For mobile PCs: The dynamic range requirements are relaxed by 10 dB FS A.
The THD+N requirements are relaxed by 10 dB FS.
The required frequency response is 20 Hz to 15 kHz, measured using 3 dB corners.
The cross-talk requirements are relaxed by 10 dB FS.

[17.5] Audio subsystem supports basic data formats **in full duplex**

Windows 98 and Windows 2000 provide software mixing and sample rate conversion (SRC), which eliminate the need for hardware to support all possible rates. Therefore, the hardware is required to support only two key rates: 44.1 and 48kHz:

?? 44.1kHz is required for efficiency reasons. Most game content uses a sampling rate that is an integer multiple of 44.1 kHz. In addition, CD audio is 44.1kHz. When the highest input stream is 44.1kHz and below, the optimal way to operate the audio output is to convert everything to 44.1kHz and run the audio device at this rate. This conversion provides the best quality and least CPU overhead.

?? 48kHz is required because it is the highest frequency that consumer content uses. DVD audio is a good example. When 48kHz content is present, the operating system ~~will switch~~switches the audio output to 48kHz.

To meet output performance requirements of section 17.4, audio subsystems that provide output conditioning to enhance speaker performance must provide separate speaker and line outputs, or must provide means to disable output conditioning.

[NEW] [17.6] Audio subsystem supports Full Duplex operation

Full duplex audio is essential to support emerging communications applications such as IP telephony, conferencing, and network gaming. These applications require the audio system to play back and record simultaneously. The following requirements ensure that full duplex operation is available and performance is consistent across implementations.

?? **[NEW] Full Duplex operation for all supported sampling rates.** Where built-in or external audio device includes both input and output capability, full duplex operation must be supported for basic formats (16-bit, 44.1 and 48 kHz), and for all other formats (e.g. at 8, 11.025, 16, 22.05, and/or 32 kHz) supported by the hardware.

?? [NEW] Sample rates are time-synchronized when same rates are requested. Where built-in or external audio device includes both input and output capability, when the same sample rate is selected for both input and output, the sample rates for each must be time-synchronized. For instance, if 44.1 kHz is selected for both input and output, audio hardware must ensure that the sampling rate for input and output is identical (that is, based on the same clock).

Where built-in or external audio device includes both input and output capability, incoming and outgoing audio must be capable of operating at independent sampling rates. Voice recognition and audio/video conferencing require the audio system to simultaneously play back and record. Incoming and outgoing audio should be capable of operating at independent sampling rates. This requirement considers the entire system, including the possibility of USB speakers or microphones.

[17.8] Audio driver reports sample position for stream synchronization

The driver must be capable of reporting within 1 ms the current position of the buffer being rendered, in relation to the samples given to the codec. This requirement applies for both compressed and uncompressed data.

For information about WDM device driver support for streaming capabilities, see the Windows 2000 DDK. See also the related articles available on the web at <http://www.microsoft.com/hwdev/desinit/csa1.htm>.

For information about WDM device driver support for streaming capabilities, see the “Kernel Streaming Drivers Design Guide” in the Windows 2000 DDK (online at http://www.microsoft.com/ddk/ddkdocs/win2k/ks-overview_4svn.htm).

[17.9] [REDUNDANT] Audio connectors use icons with standard color coding

Note to Reviewers: This is a basic PC 2001 requirement

~~17.10 [DELETE] Audio subsystem provides sufficient externally accessible inputs and outputs~~

Note to Reviewers: Recommendations are not included in PC 2001.

~~17.11 [MOVED] Microphone meets performance recommendations for PC 99 speech-recognition microphones~~

[NEW] Systems with embedded transducers meet PC2001 cross-coupling specifications

Most specifications and tests isolate half-duplex play or record performance. Additional attention should be paid to full-duplex systems with an embedded microphone and speakers, such as mobile PCs and multimedia monitors, where acoustic coupling can significantly degrade microphone performance.

~~17.7 [MOVED] Analog microphone input meets PC 2001 jack and circuit specifications~~

Note to Reviewers: See “Requirements for Voice Input” later in this chapter.

[NEW] If implemented, 3D and 4D audio use required APIs

Note to Reviewers: In a future draft version, Microsoft will propose a requirement that exposure of these, capabilities if implemented, must conform with APIs provided by DDK.

[17.12] [TBD] Audio subsystem provides hardware or software support for DLS

Note to Reviewers: Recommendations are not included in PC 2001. In a future draft, Microsoft will propose new requirements related to DLS

Requirements for Voice Input

This section discusses incremental requirements for audio subsystem and peripheral devices to support applications requiring voice input on the PC. Applications include IP telephony, conferencing, and speech recognition.

These requirements ensure microphone input compatibility for voice-input enabled applications such as speech recognition, speakerphone telephony, and conferencing.

[17.7] If implemented, analog microphone input meets PC 2001 jack and circuit specifications

This requirement provides a more detailed specification for the analog characteristics of the microphone input jack.

~~The specification is requirement~~ enables users with electret or dynamic microphones to connect the device to their PC and achieve consistent results. These requirements also maintain compatibility with the installed base of microphones. For information about optional close speaking headset microphones, see requirement [17.11](#), “Microphone meets performance recommendations for PC 2001 speech-recognition microphones.”

If the PC has an analog microphone input, it must meet the following specifications:

?? Three-conductor 1/8 inch (3.5 mm) tip/ring/sleeve microphone jack where the mic signal is on the tip, bias is on the ring, and the sleeve is grounded. This design is optimized for electret microphones with three-conductor plugs, but will also support dynamic microphones with two-conductor (ring and sleeve shorted together) plugs.

- ?? Minimum AC input impedance between tip and ground: minimum, 4 kOhm; recommended, 10 kOhm.
- ?? Input voltages of 10–100 mV deliver full-scale digital input, using software-programmable ?20 dB gain for low output microphones.
- ?? Maximum 5.5 V with no load, minimum 2.0 V with 0.8 mA load, DC bias for electret microphones.
- ?? Minimum bias impedance between bias voltage source and ring: 2 kOhm.
- ?? AC coupled tip.

~~It is recommended that the PC analog microphone input also meet the following specifications:~~

- ~~? Input voltage of mV delivers full-scale digital input, using software-programmable ?20 dB gain for low output microphones.~~
- ~~? AC coupled tip to implement analog (external to ADC) 3 dB roll-off at 60 Hz and 15 kHz.~~

Note: These ~~specifications-requirements~~ are designed to ensure that when capturing a 100 mV signal from the microphone input at 22.050 or 44.1 kHz, the audio system delivers a digitized ?8.8 kHz bandwidth input signal with ?70 dB FS A weighted dynamic range (SNR) and ?-60 dB FS unweighted THD+N. See also [17.4], “Audio performance meets PC 2001 requirements.”

Note to Reviewers: Recommendations are not included in PC 2001.

[17.11] **If implemented, close-speaking headset** microphone meets performance ~~recommendations-requirements~~ for PC 2001 speech-recognition microphones

The following requirements are for close-speaking headset microphones intended for use in speech-recognition applications.

Note to Reviewers: These guidelines represent a consensus on optimal characteristics for close speaking headset electret microphone used for speech recognition. They should enable developers of speech recognition software to provide the OEM or retail customer with a list of devices designed to work optimally with a PC 2001-compliant microphone input jack.]

These guidelines are compatible with most of the installed base of sound cards and audio-enabled system boards. For more information about the microphone jack requirements, see requirement 17.7, “Analog microphone input meets PC 2001 jack and circuit specifications.”

The ~~recommendations-requirements~~ for a PC 2001 speech-recognition microphone are:

?? Close speaking headset design positions microphone within 1.5 inches of the *corner* of the speaker's mouth

?? Full scale output voltage: 100 mV (0 dB FS)

?? Microphone connector is three-conductor 1/8 inch (3.5 mm) tip/ring/sleeve microphone jack where the mic signal is on the tip, bias is on the ring, and the sleeve is grounded. This design is optimized for electret microphones with three-conductor plugs, but will also support dynamic microphones with two-conductor (ring and sleeve shorted together) plugs.

?? Operating bias voltage from 2.0–5.0 Volts Direct Current (VDC) with a maximum current drain of 0.8 mA

?? Capable of sustaining a maximum voltage of 10 VDC on tip or ring without damage

It is also required that a PC 2001 speech-recognition microphone meet the following specifications:

?? Frequency response:

?? ?~~5~~3 dB from 100 Hz to 10kHz

?? 0 dB at 1 kHz

?? Minimum sensitivity of –44 dB relative to 1V/Pa

?? Maximum 2% Total Harmonic Distortion (THD) 100 Hz~~hZ~~ to 10kHz at 94 dBSPL

?? Noise cancellation null sensitivity at 90 and 270 degrees +/- 10 degrees with the following minimums:

20 dB at 100 Hz

20 dB at 4000 Hz

20 dB at 400 Hz

10 dB at 10 kHz

20 dB at 1000 Hz

?? Maximum wind noise sensitivity of –65 dB with 0 dB = 1 V (measured with wind speed of 1m/s at the 0 degree axis of microphone)

?? Maximum output impedance of 1 kOhm (using a 1 kHz full-scale test tone with 2.0 VDC bias)

Close talking (pressure gradient) headset microphones detect the pressure difference between the microphone sound ports. This pressure difference results from dispersion of sound pressure as the utterance exits a user's mouth; the BK 4227 simulates this dispersion. When the distance from the aperture to the test microphone is specified, and a constant sound pressure is maintained at the test microphone location, near field sensitivity and frequency response of the headset microphone can be accurately measured. The test distance is 6mm from the top surface of the Mouth Simulator, along the centerline of the aperture.

In practice, it is not possible for the reference microphone and test microphone to occupy the same physical location. Since the microphone location is critical to the realized pressure differential at this close distance, the sound pressure is correlated at this location (using a free field reference microphone) to the sound pressure of a pressure reference microphone installed in the B&K 4227. This correlation allows the sound field compressed with the installed microphone to be corrected to the sound field at the test position, and allows the correct near field frequency response for the headset microphone to be measured.

[17.13] Audio subsystem supports AEC reference inputs

Built-in or external audio devices that include both input and output capability and introduce additional digital or analog audio sources into the final mix (that is, mixing, music synthesis, and so on) ~~to~~ must support simultaneous capture of microphone and acoustic echo cancellation (AEC) reference inputs.

At minimum, audio hardware must enable mono mix of final output and microphone input (post microphone gain) to be routed through the line input, with microphone input routed to in left channel and mono mixed output in right channel. Since this routing utilizes existing line-in A/D converters, little additional burden is placed on the hardware implementation.

Alternatively, audio hardware may implement an independent microphone input channel with associated A/D conversion, and enable stereo mix of final output to be routed through line input, or through entirely independent input channel. The reference should be time-synchronized and available at the same sample rate as the microphone input.

For more information, see Section 6.2 of *Audio Codec '97 Component Specification* from Intel Corporation, which describes one possible implementation. This specification is available at <http://developer.intel.com/pc-supply/platform/ac97/>.

Requirements for Multi-Channel Audio

This section addresses requirements to support multi-channel audio, whether discreet or encoded.

[17.15.] If system supports video playback, CD, DVD, and broadcast audio playback meet PC 2001 requirements

These capabilities are specified to ensure quality playback of MPEG-2 audio from any source, including DVD, digital broadcast or satellite systems, hard drives, and so on. The goal for DVD and other audio/video playback is to ensure that the end-user experience is the same or better than from a stand-alone DVD player.

For those PCs that support software or hardware decoding and playback of DVD-Video or MPEG-2 video, the audio decoder must be capable of supporting

one or both of the following formats is required, depending upon the local requirements for DVD audio:

- ?? AC-3 (Dolby Digital) less than or equal to 5.1 channels, at 48 kHz less than or equal to 448 Kbps
- ?? MPEG-2 multi-channel less than or equal to 5.1 channels, at 48 kHz less than or equal to 912 Kbps
- ?? MPEG-1 Layer 2 stereo, at 44.1 and 48 kHz less than or equal to 448 Kbps
- ?? LPCM less than or equal to 8 channels, 16-bit, 20-bit, and 24-bit at 48 or 96 kHz less than or equal to 6.144 Mb/s

Note: Conversion to 44.1-kHz or 48-kHz 16-bit stereo is acceptable when the content exceeds the available resolution, sampling rates, or number of output channels.

[NEW] Audio subsystems supporting S/P-DIF output provide write-through capability

Some audio hardware may provide the ability to mix multi-channel audio down to a composite multi-channel format (Dolby Surround, AC-3, and so on) and direct this to S/P-DIF output. Such hardware must provide a mode of operation that allows previously encoded data to be passed through the S/P-DIF connector unaltered.

Note to Reviewers: Please provide clarifying language to ensure requirements are correctly represented.

Requirements for Digital Audio

This section discusses requirements for audio devices implemented for USB and 1394.

[17.17] [REDUNDANT] Audio subsystem does not provide a DB-15 analog joystick/MIDI port

Note to Reviewers: “No legacy and proprietary devices” is a basic PC 2001 requirement

[17.18] [REDUNDANT] Each hardware device has a unique Plug and Play device ID

Note to Reviewers: This is a basic PC 2001 requirement and will not be repeated in each device chapter

[17.19] {REDUNDANT} Dynamic resource configuration is supported for all devices

Note to Reviewers: This is a basic PC 2001 requirement and will not be repeated in each device chapter

[17.20] [REDUNDANT] PCI device conforms to PCI 2.2 and additional PC 2001 requirements

Note to Reviewers: This is a basic PC 2001 requirement

[17.21] PCI device, if implemented, supports initiator, target, and block transfer

For complete implementation details, see PCI 2.2.

Full-duplex audio sample transport must be supported using separate PCI bus mastering hardware for playback and capture sample streams.

~~It is desirable for~~ Sample transport mastering hardware ~~to~~ should support burst capabilities in order to read or write multiple samples within the same PCI bus transaction. This ~~support will~~ lessens the impact of sample transport on other agents in the system, which ~~will have~~ has a positive effect on the system's responsiveness.

17.22 PCI device, if implemented, supports efficient audio buffer management
~~non-DWORD-aligned audio buffers~~

The audio device ~~should~~ must not consume more than two percent of the CPU transferring audio data. This maximum is two percent for all streams, not per stream.

The audio device ~~should~~ must be able to fully function when the system can only provide single pages of contiguous memory. In other words, the audio device can require many pages of memory, but ~~should~~ must not require the largest block of contiguous memory to exceed one page. This requirement ensures audio support in docking and dynamic loading scenarios where memory may be completely fragmented page-wise.

The audio device ~~should~~ must not introduce more than 1ms latency. In this context, latency is defined as the time between when the driver receives the audio data and when the audio data leaves the device. 17.23 [Subsumed into 17.3]

~~[17.23]—[Subsumed into 17.3]~~

[17.24] PCI device, if implemented, is digital ready

To transfer digital audio to USB or IEEE 1394 devices, all digital audio data created in the PC must be available to the operating system for mixing and streaming. All PCI audio devices must be able to route the final mix of all digital audio data created or processed on-chip to the host using bus master transfers.

For example, a PCI audio device provides HRTF 3-D filtering and wave-table synthesis. After mixing all of the separate 3-D sources and wave-table channels down to a single stereo stream, the device transfers the data to host memory.

PC 2001 requires ~~that~~ all output channels to be available to the host for redirection. If the device supports more than two output channels, for example, four or six, ~~it is required that~~ all output channels must be redirectable to the host.

[17.25] USB Audio, if implemented, meets USB specification and USB audio device class specification

The device must comply with *Universal Serial Bus Specification, Version 1.0* or later, and with *USB Device Class Definition for Audio Devices, Version 0.9* or later. This requirement ensures that all Plug and Play requirements are met and that drivers provided with the operating system support this device.

[17.26] USB audio device, if implemented, uses MMHID for control of basic functions

If the USB audio device implements a volume or pan control, it must use the Multimedia Human Interface Device (MMHID) protocol to communicate these changes to and from the host.

[17.27] IEEE 1394 audio, if implemented, meets PC 2001 requirements for IEEE 1394

IEEE 1394 audio peripherals must meet the requirements defined in Chapter 8, “IEEE 1394.”

Power Management for Audio

This section summarizes the power management requirements for audio components.

[17.28] [REDUNDANT] System and device comply with PCI bus power management specification

Note to Reviewers: This is a basic PC 2001 requirement for PCI devices

[17.29] Audio device complies with device class power management reference specification

Audio devices must comply with *Audio Device Class Power Management Reference Specification, Version 1.0* or later, which provides definitions of the OnNow device power states (D0–D3) for these devices. The specification also covers the device functionality expected in each power state and the possible wake-up event definitions for the class. The device and driver are required to implement support for power states D0, D2, and D3. Other power states are optional.

Audio devices implemented on the system board must comply fully with the ACPI 1.0~~ba~~ specification (or later).

Device Drivers and Installation for Audio

This section summarizes requirements for audio device drivers.

[17.30] [REDUNDANT] Device drivers and installation meet PC 2001 requirements

Note to Reviewers: This is a basic PC 2001 requirement for all devices

[17.31] Audio meets PC 2001 requirements for WDM driver support

All audio devices must have drivers that use the WDM architecture exclusively. Audio devices must not use VxDs. The manufacturer can either supply a WDM driver with the audio device or rely on a WDM driver provided with Windows 98 and Windows 2000. For information, see the Windows 2000 DDK.

[17.32] Applications provided with device meet Win32 requirements

Any Windows-based applications provided with the device must meet software compatibility requirements as defined in the Microsoft Platform SDK.

Requirements for Mobile PC Audio

This section covers audio for the Mobile PC.

[6.12] Mobile PC ~~that~~ includes audio ~~that~~ meets Mobile PC 2001 audio requirements

Audio must meet the requirements for PC 2001 audio as defined in earlier sections of this chapter, with exceptions as defined in this section. These exceptions for Mobile PC systems arise from design challenges such as lower power and smaller form factors.

For Mobile PCs, the following exceptions and differences are defined for audio requirement [17.4], “Audio performance meets PC 2001 requirements”:

Note to Reviewers: Specific changes to advance mobile audio capabilities will be identified in subsequent revisions of this document.

- ?? Dynamic range requirements are relaxed by 10 dB FS A
- ?? THD+N requirements are relaxed by 10 dB FS
- ?? Required frequency response is 20 Hz to 15 kHz, measured using 3 dB corners
- ?? Cross-talk requirements are relaxed by 10 dB FS

?? For Mobile PCs that implement a 3.3 V audio codec in order to decrease system power, the required Full Scale Output Voltage (FSOP) for line output is 0.7 Vrms

Notice that frequency response is measured at line out.

~~It is the intent of~~ The PC 2001 design requirements ~~to~~ allow for the audio controller to be implemented on the mobile unit with output capabilities implemented on a docking station. For related audio requirements for the mobile PC/docking station pair, see the “Docking Station Requirements” section later in Chapter 15, “Mobile Computing.”

[6.37] If audio is implemented, docking station/mobile pair meets PC 2001 audio requirements

If audio is implemented, the docking station/mobile PC pair must meet the requirements for PC 2001 audio as defined in Chapter 17, “Audio Components,” with additional requirements as follows:

?? The user must ~~be able~~ not be required to select speakers in the mobile unit or the docking station upon docking.

?? The docking station is not required to implement full desktop audio capabilities, but it can supplement the audio capabilities of the mobile unit.

Checklist for PC 2001 Audio

- [17.2] [REDUNDANT] Audio device does not connect to ISA bus
- [17.3] Audio device does not use legacy hardware interfaces for MS-DOS-based applications
- [17.4] If implemented, audio performance meets PC 2001 requirements
- [17.5] Audio subsystem supports basic data formats
- [NEW] [17.6] Audio subsystem supports Full Duplex operation
- [17.8] Audio driver reports sample position for stream synchronization
- [17.9] [REDUNDANT] Audio connectors use icons with standard color coding
- [NEW] Systems with embedded transducers meet PC2001 cross-coupling specifications
- [NEW] If implemented, 3D and 4D audio use required APIs
- [17.12] [TBD] Audio subsystem provides hardware or software support for DLS
- [17.7] If implemented, analog microphone input meets PC 2001 jack and circuit requirements
- [17.11] If implemented, close-speaking headset microphone meets performance requirements for PC 2001 speech-recognition microphones
- [17.13] Audio subsystem supports AEC reference inputs
- [17.15.] If system supports video playback, CD, DVD, and broadcast audio playback meet PC 2001 requirements
- [NEW] Audio subsystems supporting S/P-DIF output provide write-through capability
- [17.17] [REDUNDANT] Audio subsystem does not provide a DB-15 analog joystick/MIDI port
- [17.18] [REDUNDANT] Each hardware device has a unique Plug and Play device ID
- [17.19] ~~[REDUNDANT]~~ Dynamic resource configuration is supported for all devices
- [17.20] [REDUNDANT] PCI device conforms to PCI 2.2 and additional PC 2001 requirements
- [17.21] PCI device, if implemented, supports initiator, target, and block transfer
- 17.22 PCI device, if implemented, supports efficient audio buffer management
- [17.24] PCI device, if implemented, is digital ready
- [17.25] USB Audio, if implemented, meets USB specification and USB audio device class specification
- [17.26] USB audio device, if implemented, uses MMHID for control of basic functions
- [17.27] IEEE 1394 audio, if implemented, meets PC 2001 requirements for IEEE 1394
- [17.28] [REDUNDANT] System and device comply with PCI bus power management specification
- [17.29] Audio device complies with device class power management reference specification
- [17.30] [REDUNDANT] Device drivers and installation meet PC 2001 requirements
- [17.31] Audio meets PC 2001 requirements for WDM driver support
- [17.32] Applications provided with device meet Win32 requirements
- [6.12] Mobile PC that includes audio meets Mobile PC 2001 audio requirements
- [6.37] If audio is implemented, docking station/mobile pair meets PC 2001 audio requirements